felt has a stiffness of 12000N/m and equivalent viscous damping coefficient of 330N-sec/m.Determine undamped and the damped natural frequencies of the system in vertical direction. (16)

9. (i) A cantilever shaft 50mm diameter and 300mm long has a disc of mass 100kg at its free end. The young's modulus for the shaft material is 200GN/m2.SDetermine the frequency of longitudinal and transverse vibration of the shaft. (10)

(ii)Explain the sketches different cases of damped vibrations. (6)

10. The barrel of a large gun recoils against a spring on firing. At the end of the firing, a dashpot is engaged that allows the barrel to return to its original position in minimum time without oscillation. Gun barrel mass is 400kg and initial velocity of recoils 1m.Determine spring stuffiness and critical damping coefficient of dashpot. (16)

11. A steel shaft 100mm in diameter is loaded and support in shaft bearing 0.4m apart. The shaft carries three loads: first mass 12kg at the centre, second mass 10kg at a distance 0.12m from the left bearing and third mass of 7kg at a distance 0.09m from the right bearing. Find the value of the critical speed by using Dunker ley's method. $E=2X10^{11}N/m^2$ (16)

UNIT-IV (FORCED VIBRATION)

PART-A **(2 marks)**

1. Define damping ratio or damping factor.
2. Define logarithmic decrement.
3. Give equation for damping factor ζ and damped frequency ωd.
4. What is meant by harmonic forcing?
5. What is the relationship between frequencies of undamped and damped vibration?
6. What is meant by dynamic magnifier or magnification factor?
7. Define transmissibility.
8. Define transmissibility ratio or isolation factor.
9. What is vibration isolation?
10. Sketch the graph for (ω/ωn) Vs Transmissibility for different values of damping factor.

PART-B (FORCED VIBRATION) **(16 marks)**

1.A mass of 50kg is supported by an elastic structure of total stiffness 20KN/m.The damping ratio of the system is 0.2.A simple harmonic disturbing force acts on the mass and at any time 't seconds, the force is 60sin10t newtons.Find amplitude of the vibration and phase angle caused by the damping. (16)

2. A mass of 50kg is supported by an elastic structure of total stiffness 20KN/m.The damping ratio of the system is 0.25.A simple harmonic disturbing force acts on the mass and at any time 't seconds, the force is 75cos12t newtons.Find amplitude of the vibration and phase angle caused by the damping. (16)

3. A mass of 10kg is suspended from one end of a helical spring, the other end being fixed. The stiffness of the spring is10N/mm.The viscous damping causes the amplitude to decreases to one-tenth of the initial value in four complete oscillations. If a periodic force of 150cos50t N is applied at the mass in the vertical direction .Find the amplitude of the forced vibrations? What is its value of resonance? (16)

4. A harmonic exiting force of 25N is acting on a machine part which is having a mass of 2Kg and vibrating in viscous medium. The exciting force causes resonant amplitude of 12.5mm with a period of 0.2sec. (16)

5. A body having a mass of 15kg is suspended from a spring which deflects 12mm under the weight of the mass. Determine the frequency of the free vibrations. What is the viscous damping force needed to make the motion a periodic at a speed of 1mm/s?If, when damped to this extend a disturbing force having a maximum value of 100N and vibrating at 6Hz is made to act on the body, determine the amplitude of the ultimate motion. (16)

6. A single cylinder vertical petrol engine of total mass of 200kg is mounted upon a steel chassis frame. The vertical static deflection of the frame is 2.4mm due to the weight of the engine .The mass of the reciprocating parts is 18kg and stroke of piston 160mm with S.H.M.If dashpot of damping coefficient of 1N/mm/s used to damped the vibrations, calculate al steady state (i)Amplitude of vibrations at 500rpm engine speed.(ii)The speed of the driving shaft at which resonance will occurs. (16)

7. A vertical single stage air compressor having a mass of 500kg is mounted on spring having stiffness of $1.96X10^5$N/m and dashpot with damping factor of 0.2m.The rotating parts are completely balanced and the equivalent reciprocating parts weight 20kg.The stroke is 0.2m.Determine the dynamic amplitude of vertical motion of the excitation force if the compressor is operate at 200rpm. (16)

8. A machine 100kg has a 20kg rotor with 0.5mm eccentricity. The mounting spring have $s=85x10^{3.}$
The operating speed is 600rpm and the unit is constrained to move vertically. Find (i) Dynamic amplitude of machine (ii) the force transmitted to the support. (16)

9.A single cylinder engine has an out of balance force of 500N at an engine speed of 30rpm.The total mass of engine is 150kg and its carried on a set of total stiffness 300N/cm.
(i) Find the amplitude of steady motion of the mass and maximum oscillating force transmitted to the foundation.
(ii)If a viscous damping is interposed between the mass and the foundation the damping force 1000N at 1m/s of velocity, find the amplitude of force damped oscillation of the mass and its angle of lag with disturbing force.
` (16)

10. An industrial machine weighting 445kg is supported on a spring with a statical deflection of 0.5cm.If the machine has rotating imbalance of 25kg-cm.Determine the force transmitted at 1200rpm and the dynamic amplitude at the speed. (16)

11. The mass of an electric motor is 120kg and it runs at 1500rpm.The armature mass is 35kg and its centra gravity lies 0.5mm from axis of rotation. The motor is mounted on five springs of negligible damping. So that the force transmitted is one-eleventh of the impressed force. Assume that the mass of the motor is equally distributed among the five springs. Determine (i) the stiffness of the spring (ii) the dynamic force transmitted to the base at the operating speed. (iii) Natural frequency of system. (16)